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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,186	02/09/2004	Kia Silverbrook	MTB25US	8433

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SILVERBROOK RESEARCH PTY LTD
393 DARLING STREET
BALMAIN, 2041
AUSTRALIA

EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	PAPER NUMBER
2861	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/773,186	SILVERBROOK, KIA	
	Examiner	Art Unit	
	SHELBY FIDLER	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2/27/08 & 4/29/08*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/28/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/27/2008 has been entered.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 1/28/2008 has been considered by the examiner.

Claim Objections

Claims 1, 19, and 38 are objected to as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims state that the "heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element." However, this limitation seems to contradict itself. For the sake of explanation, assume that the heater element has two bubble nucleation sections. According to this claim language, when we consider the cross section of the

first bubble nucleation section, it should be smaller than each remaining part of the heater element. However, the remainder of the heater element also includes the second bubble nucleation section, which (according to the currently amended claim) should also have a cross section that is smaller than each remaining part of the heater element. Therefore, it seems impossible for "each bubble nucleation section" to be smaller than "the remainder of the heater element." Please find alternate terminology to describe this feature of the invention. Also, these claims state that the printhead comprises "a bubble forming chamber corresponding to each of the nozzles respectively." This limitation seems to state that a single bubble forming chamber is utilized for all of the nozzles. However, upon review of Applicant's original disclosure, Examiner was unable to find such a teaching. Rather, it appears that Applicant's printhead comprises a plurality of bubble forming chambers, wherein each of the bubble forming chambers correspond to one of the plurality of nozzles.

Claims 1, 19, and 38 are objected to because of the following informalities: please change "the heater element" to "the at least one heater element" to correct a minor problem of antecedent basis. Appropriate correction is required.

Claims 17 and 36 recites the limitation "said part of the bubble forming liquid." There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 5, 11-13, 19, 21, 24, 30-32, 38, 40, 42, 47-48, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 4870433) in view of Kubby (US 5487483).

Regarding claims 1, 19, and 38 (as best understood):

Campbell et al. disclose an inkjet printhead comprising:

a plurality of nozzles (nozzles 19) that are disposed in a plane of the printhead (Figs. 1-2);

a bubble forming chamber (print cavity 21) corresponding to each of the nozzles respectively (Fig. 2);

at least one heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element configured for thermal contact with a bubble forming liquid (col. 3, lines 8-11); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 8-13); wherein,

the heater element has at least one bubble nucleation section (elongated portions 31), each bubble nucleation section (31) having a smaller cross section than other sections of the heater element (as compared to end portions 32 as shown in Figs. 2-3);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68); and

wherein the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

Campbell et al. do not expressly disclose a projecting nozzle rim formed about each of the nozzles respectively, each nozzle rim being configured to direct the drops ejected from the respective nozzle in a particular direction.

However, Kubby discloses a projecting nozzle rims (lip 50) that are formed about nozzles (Fig. 5E) such that the rims project in a direction that is perpendicular to the plane of the printhead so as to direct the drops ejected from the nozzle (Fig. 5E). Kubby teaches that these nozzle rims prevent ink from adhering to the front face of the nozzle (col. 4, lines 14-17).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize projecting nozzle rims, such as those disclosed by Kubby, into the nozzle plate of Campbell et al.

Regarding claims 3, 21, and 40:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the bubble forming chamber (21) has a circular cross section (Fig. 1) and the heater element (12) has sections that are concentric with the circular cross section (Figs. 1-3).

Regarding claims 5, 24, and 42:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

Regarding claims 11, 30, and 47:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the heater elements (12) have two opposite sides (e.g. the sides relating to the top of Fig. 3 and bottom of Fig. 3) and are configured such that the gas bubble (22) formed by the heater elements are formed at both of the sides of the heater elements (col. 3, lines 50-60).

Regarding claims 12, 31, and 48:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the bubble (20), which each heater element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 3, lines 60-66).

Regarding claims 13, 32, and 50:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, and **Campbell et al. also disclose** a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself, to a system comprising the

device, or to a method of using the device. Therefore, Examiner has not given this limitation patentable weight.

Claims 1, 19, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (US 6120135) in view of Lee et al. (US 6460961 B2) and Kubby (US 5487483).

Regarding claims 1, 19, and 38 (as best understood):

Murthy et al. disclose an inkjet printhead comprising:

a plurality of nozzles (openings 32) that are disposed in a plane of the printhead (Fig. 2);

a plurality of bubble forming chambers (bubble chambers 50), each bubble forming chamber corresponding to one of the plurality of nozzles, respectively (Fig. 2);

at least one heater element (resistive heating element 12) disposed in each of the bubble forming chambers respectively (col. 3, lines 55-59 & Fig. 2), each heater element being configured for thermal contact with a bubble forming liquid, such that heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, line 64 – col. 4, line 3); wherein,

the at least one heater element has at least one bubble nucleation section (col. 7, lines 53-67).

Murthy et al. do not expressly disclose that the bubble nucleation sections each have a smaller cross section than other sections of the heater element, or that a projecting nozzle rim is formed about each of the nozzles.

However, Lee et al. disclose a heater element comprising a plurality of bubble nucleation sections (heating elements 120, 150), wherein one of the bubble nucleation sections (120) has a smaller cross section than other sections of the heater element (Figs. 5 & 7); and

Kubby discloses a projecting nozzle rims (lip 50) that are formed about nozzles (Fig. 5E) such that the rims project in a direction that is perpendicular to the plane of the printhead so as to direct the drops ejected from the nozzle (Fig. 5E).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Murthy et al.'s heater elements to attain the bubble nucleation sections disclosed Lee et al., since Lee et al. teach that these heater elements allow for production of droplets of varying sizes (col. 1, lines 57-63). It would have been further obvious to utilize projecting nozzle rims, such as those disclosed by Kubby, into the nozzle plate of Campbell et al., since Kubby teaches that these nozzle rims prevent ink from adhering to the front face of the nozzle (col. 4, lines 14-17).

Regarding claims 8, 27, and 44:

Murthy et al. as modified by Lee et al. and Kubby discloses all the limitations of claims 1/19/38, and **Murthy et al. also disclose** that each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be

applied to that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (col. 11, lines 55-64).

Regarding claims 17, 36, and 53:

Murthy et al. as modified by Lee et al. and Kubby discloses all the limitations of claims 1/19/38, and **Murthy et al. also disclose** that each heater element includes a solid material (TaO) and is configured for a mass of less than 10 nanograms of the solid material to be heated to a temperature above the boiling point to heat a part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of the drop (using the known approximate thin film TaO density of 3.8 g/cm^3, and given the heater element dimensions disclosed in col. 11, lines 55-64, the total mass of the heater element is 1.2 nanograms).

Claims 6, 10, 14, 25, 29, 33, 43, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Kubby, as applied to claims 1, 19, 38 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Campbell et al. as modified by Kubby discloses all the limitations of claims 1/19/38, but **Campbell et al. as modified by Kubby does not expressly disclose** that the printhead is a page-width printhead.

However, Silverbrook discloses that, by utilizing a pagewidth printhead (head 200), a printer is able to print on the width of an A4 page (col. 6, lines 7-12).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to make the ink jet printhead of Campbell et al. as modified by Kubby to be a pagewidth printhead, such as disclosed by Silverbrook.

Regarding claims 10, 29, and 46:

Campbell et al. as modified by Kubby discloses all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the printhead comprises a substrate (substrate 18).

Campbell et al. as modified by Kubby does not expressly disclose that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$). Silverbrook teaches that, by utilizing such a nozzle density, the printer can provide four nozzles per pixel, which can provide up to 16 drops per nozzle (col. 16, lines 60-62).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface having a nozzle density of 10,000 nozzles per square centimeter, such as disclosed by Silverbrook, into the printhead of Campbell et al. as modified by Kubby.

Regarding claims 14, 33, and 49:

Campbell et al. as modified by Kubby discloses all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the printhead comprises a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Campbell et al. as modified by Kubby does not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11). Silverbrook teaches that, by utilizing such a structure, the printhead is provided with increased levels of protection against the air (col. 9, lines 5-8).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize an overcoat layer, such as disclosed by Silverbrook, onto the substrate of Campbell et al. as modified by Kubby.

Claims 15, 18, 34, 37, 51, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Kubby (US 5851412).

Regarding claims 15, 34, and 51:

Campbell et al. as modified by Kubby discloses all the limitations of claims 1/19/38, and **Campbell et al. also disclose** that the printhead comprises a plurality of bubble forming chambers (21) each corresponding to a respective nozzle (Fig. 2).

Campbell et al. as modified by Kubby does not expressly disclose that a plurality of the heater elements are disposed within a bubble forming chamber, the heater elements within each chamber being formed on different respective layers to one another.

However, Kubby '412 discloses a printhead comprising a plurality of heater elements (doped regions 20a and 20b) that are disposed within a bubble forming chamber (Figs. 4 and 5), the heater elements within each chamber being formed on different respective layers to one another (Fig. 4). Kubby '412 teaches that, by utilizing such layered heater elements, the printer is able to emit a plurality of droplets of distinct sizes (col. 5, lines 11-21).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to modify the printhead of Campbell et al. as modified by Kubby so as to include a plurality of heater elements disposed on different layers, such as suggested by Kubby '412.

Regarding claims 18, 37, and 54:

Campbell et al. as modified by Kubby disclose all the limitations of claims 1/19/38, but **Campbell et al. as modified by Kubby does not expressly disclose** that the heater elements are covered by a conformal protective coating, the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless.

However, Kubby '412 discloses a printhead in which heater elements (doped regions 20a and 20b) are covered by a conformal protective coating (e.g. tantalum)

which has been applied substantially to all sides of the heater element such that the coating is seamless (col. 4, lines 33-44 and Fig. 4). Kubby '412 teaches that this protective coating prevents corrosion of the semiconductor structures by the liquid ink (col. 4, lines 37-39).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a protective coating, such as suggested by Kubby '412, onto the heater elements of Campbell et al. as modified by Kubby.

Claims 16, 35, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Chan (US 5710070).

Regarding claims 16, 35, and 52:

Campbell et al. as modified by Kubby discloses all the limitations of claims 1/19/38, but **Campbell et al. as modified by Kubby does not expressly disclose** that the heater elements are formed of solid material more than 90% of which is constituted by at least one periodic element having an atomic number below 50.

However, Chan discloses heater elements (resistive layer 26) that are formed of solid material (Ti and TiN) more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (col. 3, lines 30-33). Chan teaches that utilizing titanium and titanium nitride provides resistive layers that have good electro-migration performance, so as to sustain high current density at high temperatures (col.3, lines 30-33).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride, such as suggested by Chan, into the printhead of Campbell et al. as modified by Kubby.

Double Patenting

Claim 1 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 19 of copending Application No. 11/926121 in view of Kubby (US 5487483).

Regarding claim 1:

Claim 19 of copending Application No. 11/926121 disclose all the limitations of currently amended claim 1, except that a projecting nozzle rim is formed about each of the nozzles.

However, Kubby discloses a projecting nozzle rims (lip 50) that are formed about nozzles (Fig. 5E) such that the rims project in a direction that is perpendicular to the plane of the printhead so as to direct the drops ejected from the nozzle (Fig. 5E). Kubby teaches that these nozzle rims prevent ink from adhering to the front face of the nozzle (col. 4, lines 14-17).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize projecting nozzle rims, such as those disclosed by Kubby, into the invention of claim 19 in copending Application No. 11/926121.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above rejections based on the disclosures provided by Campbell et al. and Kubby. These disclosures show that it would have been obvious to provide projecting nozzle rims formed about each of the nozzles, wherein each rim projects in a direction that is perpendicular to the plane of the printhead.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHELBY FIDLER whose telephone number is (571)272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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